

but extended itself, though considerably fainter, far into the coma.

The observation was made with the Refractor of the Observatory at Lund (aperture 245 millimètres) and a universal spectroscope by Merz with one direct vision prism.

Lund: 1882, June 5.

Elements of Comet Wells, obtained graphically.

By F. C. Penrose, Esq.

T, very roughly computed				June 10.0
$\pi - \varnothing$	...	...	...	209° 0'
\varnothing	...	...	...	205 30
i	...	...	...	74 22
D or q	...	...	...	[8.77815]

Observations of Comet b, 1881.

By T. W. Backhouse, Esq.

The accompanying table gives the brightness of the head of this comet—i.e. the nucleus with its surrounding nebulosity; the length and greatest width of the tail, as measured on Proctor's map from my drawings and notes of its position; and the direction of the tail—i.e. of the middle when it was of uniform brightness, or of the brightest line when one part was decidedly brighter than the rest of the width. The next column gives the part to which the observation of its direction refers. The last column but one gives the mode of observation: n. e. indicating the naked eye; specs., spectacles to correct my short sight; (3.5), a pair of field-glasses, power 3.5, aperture 1½ in.; (5) and (2.2), single field-glasses of these respective powers; and (20) and (38), these powers of my Cooke's 4¼-in. Refractor. The last column gives the hindrances to a perfect view. There was more or less twilight in all the earlier observations, if not up to August 3; though at midnight on July 2, 3, and 4, and from July 22, it was almost imperceptible at the comet's position.

The comet was quite white. This circumstance I noted from June 29 to July 14.

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Observations of Comet *b*, 1881.

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Mr. Backhouse, Observations

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Place and Time.	Brightness of Head.	Length of Tail.	Max. Width of Tail.	At Distance from Nucleus.	Central or Brightest Line of Tail passes or points to	at distance from nucleus.	Modes of Observation.	Twilight
Tyndrum, Perthshire.		o	o	o		o		
June 29, 13 18	—	3½	3		About Polaris		(35) n. e.	"
"	= α Urs. Maj.*; considerably fainter than Polaris†	Abt. 4 §						"
13 29	—	Abt. 5½ §						"
Sunderland.								"
July 1, 11 32	—	7½			2/3 (α, δ) Urs. Min.		"	"
11 50	—	13			1/3 (δ, ε) "		"	"
12 20	—	14½			δ Urs. Min.	3	"	"
12 40	Between ε* and ζ* Urs. Maj.; brighter than α*; brighter than γ Cass.*	18	10		1/4 (δ, ε) Urs. Min.	14½	"	"
Newhaven, Sussex.								"
July 2, 11 5	= ε Urs. Maj.*; brighter than α Urs. Maj.	17½	2½	12	2/3 (α, δ) Urs. Min.	for first 3°	"	{ Not very clear
					1/3 (δ, ε) "	4° to 17½°	"	
Abt. 12 30	—	20½	4¼	18	M. Cam.	5	"	"
					Slightly f P VI. 292	10½	"	"
					2/3 ? (P XII. 232, δ Urs. Min. 20	20	"	"

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Place and Time.	Brightness of Head.	Length of Tail.	Max. Width of Tail.	At Distance from Nucleus.	Central or Brightest Line of Tail		Modes of Observation.	Hindrances.
					passes or points to	at distance from nucleus.		
Newhaven, Sussex. July 3, 10 5	—	0	0	0	M. Cam.	$3\frac{1}{2}$	"	Twilight
10 25	—	12 $\frac{1}{2}$	1 $\frac{1}{4}$	8	$\left\{ \begin{array}{l} \frac{2}{5} (\delta, \epsilon) \text{ Urs. Min.} \\ \frac{2}{3} (\delta, \epsilon) \text{ "} \end{array} \right.$	$\left\{ \begin{array}{l} \text{lower part} \\ \text{most of tail} \end{array} \right.$	"	"
11 20	—				$\left\{ \begin{array}{l} \text{Slightly } p \text{ M Cam.} \\ \text{M. Cam.} \end{array} \right.$	$\left\{ \begin{array}{l} \text{up to } 1\frac{3}{4}^\circ \\ 3\frac{1}{2} \end{array} \right.$	(5)	"
12 10	—	17	3 $\frac{3}{4}$	12 $\frac{1}{4}$	$\left\{ \begin{array}{l} \text{P VI. 292} \\ \frac{2}{7} (\alpha \text{ Urs. Min., P XII. 232}) \end{array} \right.$	$\left\{ \begin{array}{l} 9 \\ 16 \end{array} \right.$	n. e.	"
12 15	= α Urs. Min. * ; = η Urs. Maj. *				—		"	"
4, 12 5	—	16	4 $\frac{1}{2}$	11	$\left\{ \begin{array}{l} \text{P VI. 292, or perhaps a little } f \text{ it} \\ \frac{5}{9} (\alpha \text{ Urs. Min., P XII. 232}) \end{array} \right.$	$\left\{ \begin{array}{l} 8 \\ 15 \end{array} \right.$	"	"
13 0	Scarcely fainter than α Urs. Min. * ; = ζ Urs. Maj. *				—		"	"
Darlington. July 7, 10 10	Far fainter than α Urs. Min.				—		"	"
10 50	Much fainter than ζ Urs. Maj.				—		"	"
10 50	—	Abt. 3			—		(2'2)	"
12 0	Between α and γ Urs. Maj. ?	8 $\frac{1}{2}$	1'4	7	—		n. e.	"
North Berwick. July 14, 11 50	Rather brighter than κ Draconis				—		"	"
11 55	—				The star at R.A. 155° N.D. 83°	1 $\frac{3}{4}$	(2'2)	"

Place and Time.	Brightness of Head.	Length of Tail.	Max. Width of Tail.	At Distance from Nucleus.	Central or Brightest Line of Tail passes or points to	at distance from nucleus.	Modes of Observation.	Remarks.
North Berwick. July 14, 11 55	—	$7\frac{1}{2}$	$\frac{9}{7}$	$6\frac{1}{2}$	$\frac{2}{3} (\epsilon, \zeta)$ Urs. Min.	7	n. e.	Twilight
12 15	= ϵ Cass.	$8\frac{1}{2}$			—		"	" Perhaps moonlight
Sunderland. July 20, 11 4	= κ Drac.				—		"	Twilight
12 5	Rather brighter than κ Drac.; about half way from ϵ Cass. to ζ Urs. Min.* in brightness	11	3	11	$\frac{2}{3} (\epsilon, \zeta)$ Urs. Min. $\frac{2}{3} (\epsilon, \zeta)$ "	4 11	"	"
22, 12 0		$9\frac{1}{2}$			$\frac{1}{2} (\epsilon, \zeta)$ Urs. Min.		"	Very little twilight
27, 10 15	Considerably fainter than κ Drac.; scarcely brighter than δ Urs. Min.; rather brighter than ϵ				—		"	Twilight
12 15	Rather brighter than δ Urs. Min.; slightly brighter than λ Drac.; considerably fainter than κ ; $\frac{2}{3}$ from κ Drac. to δ Urs. Min. in brightness	$9\frac{1}{2}$	2	$7\frac{1}{2}$	ζ Urs. Min.	$9\frac{1}{2}$	"	
29, 12 0	—	$8\frac{1}{2}$	1	Abt. $3\frac{1}{2}$	$\frac{1}{3} (\zeta, \epsilon)$ Urs. Min. ζ , or $\frac{1}{2} \circ n$ of it	2 $8\frac{1}{2}$	"	{ Not very clear
31, 12 37	—	8	$1\frac{1}{2}$	$3\frac{2}{3}$	$\frac{2}{3}$ or $\frac{2}{3} (\epsilon, \zeta)$ Urs. Min. $\frac{11}{12} (\epsilon, \zeta)$ "	2 8	specs.	
12 45	Slightly brighter than ζ or ϵ Urs. Min.; rather fainter than δ				—		n. e.	

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Place and Time.	Brightness of Head.	Length of Tail.	Max. Width of Tail.	At Distance from Nucleus.	Central or Brightest Line of Tail passes or points to	at distance from nucleus.	Modes of Observation.	Fin- drances.
Sunderland.								
Aug. 1, 10 42	—	0	0	0	$\frac{2}{3}$ (ϵ , ζ) Urs. Min.	2	(3'5)	Not so clear as last night
12 10	—	$7\frac{1}{2}$			ζ Urs. Min.	$7\frac{1}{2}$	n. e.	
3, 11 20	—				$\frac{3}{4}$ (ϵ , ζ) Urs. Min.	$13\frac{3}{4}$	(3'5)	Hazy
4, 12 3	—	$6\frac{1}{2}$	$1\frac{3}{4}$	5	ζ Urs. Min.	$6\frac{1}{2}$	n. e.	
12 10	Scarcely = 4 Urs. Min., but considerably brighter than 5				—		"	
12 30	—				Much to n. of ζ Urs. Min.		(3'5)	
12 50	—				—		n. e.	Twilight
5, 12 25	= about Comet c †	$6\frac{1}{4}$			ζ Urs. Min.		"	Not very clear
10, 10 45	Invisible				—		n. e. & Moon-specs.	Moonlight
10 45	—	$1\frac{1}{2}$			—		(3'5)	"
14, 10 40	Far fainter than the star at R.A. 205°, N.D. 78½°	$2\frac{1}{2}$			ζ Urs. Min.		"	"
18, 10 10	—	1			—		n. e.	Slight light from town
10 15	—	$3\frac{3}{4}$	1	Abt. 2¾	Slightly s. of θ Urs. Min.	$3\frac{3}{4}$	(3'5)	Less light if any
12 10	—	$3\frac{3}{4}$			θ Urs. Min.	$3\frac{3}{4}$	"	Moonlight

Place and Time.	Brightness of Head.	Length of Tail.	Max. Width of Tail.	At Distance from Nucleus.	Central or Brightest Line of Tail		Modes of Observation.	Hindrances.
					passes or points to	at distance from nucleus.		
Sunderland.								
Aug. 25, 10 30	Slightly brighter than P XIV. 273	2 $\frac{2}{3}$ °	Broad	°	—	°	(3.5)	
Sept. 7, 10 5	—	40'			—		(20)	Full moon
14, 11 15	—	25'	Abt. 8'		About 5° s. of <i>f</i>		(20)	Moonlight
11 30	Considerably fainter than 20 Urs. Min.	None			—		(3.5)	"
11 30	Invisible				—		n. e.	"
12 5	—	28'			—		(38)	"
16, 10 45	—	40'	Abt. 11'		About 7° s. of <i>f</i>		(20)	
11 0	Invisible				—		n. e.	
11 0	—	30'			—		(3.5)	
19, 8 20	Invisible				—		n. e.	
8 20	Considerably fainter than 20 Urs. Min., or than the star at R.A. 244°, N. D. 73 $\frac{30}{4}$	10'			—		(3.5)	
8 50	—	35'	22'		{ 5° or 10° s. of <i>f</i> 15° or 20° s. of <i>f</i>	{ 10' 35'	(20)	
Scarborough.								
Sept. 26, 10 10	Visible, together with a much fainter star near				—		n. e.	

* Means that the object, compared with Comet *b*, was more favourably situated; † much more so; ‡ less so.
§ Estimated; no stars to compare it with.

Remarks on the Tail.

June 29.—Curvature suspected. (3'5.)

July 1.—Probably curved, in lower part. (Naked eye.)

July 2, 11^h 5^m.—Slightly curved. For the first 3° the middle of the tail points to $\frac{2}{3}$ (α , δ) *Ursæ Minoris*; but this is not the brightest line, for the *p* side is slightly the brightest part in the lower portion of the comet. (Naked eye.)

12^h 30^m.—The tail has a slight appearance of bifurcation, because above this lower portion the *p* side is exceeded in brightness by the continuation of the *f* side,* which, however, ceases to be the side, since much fainter light appears on its left. The tail then becomes much more indefinite, curving considerably to the left. It is doubtful from my notes whether it passed $\frac{2}{3}$ or $\frac{3}{4}$ from P XII. 232 to δ *Urs. Min.*, but the former appears to have been correct. (Naked eye.)

July 3, 11.20.—The *p* edge much better defined than the *f* edge. This superior definition begins to be perceptible rather more than 1° from the nucleus, and increases beyond M *Cam*. (5.)

12.10.—With the exception of the first degree or two from the head, the main part of the tail is quite straight; but the appearance of curvature is produced by the diffused *f* part of the tail becoming brighter relative to the rest as it recedes from the nucleus. This diffused part causes the *f* edge of the tail to be worse defined than the *p* throughout, except at the beginning and end. (Naked eye.)

July 4, 11.42.—At 6° from the nucleus the tail is as bright as the brightest parts of the Milky Way in *Cygnus*, which are in rather darker sky. (Naked eye.)

12.5.—The *p* side the brightest from M *Cam*. to a distance of 10° from the nucleus. Curvature of lower part of tail very slight indeed. The diffused *f* part of the tail brighter relatively than on the 3rd. The *p* and *f* sides of the tail are so different that, whereas the *p* side seems an emanation from the head, the *f* side seems rather an emanation from the *p* side. (Naked eye.)

July 14, 11.55.—Tail slightly curved.

July 20, 12.5.—Tail straight, but in the lower part the brightest line is nearer the *n* than the *s* edge. (Naked eye.)

July 27, 12.15.—Ditto. ζ *Urs. Min.* is at the end of the tail, the *s* edge ending a little *s* of it; the *n* edge does not reach so far, pointing to $\frac{4}{7}$ (ϵ , ζ). The whole tail faint, except close to the nucleus. (Naked eye.)

July 31, 12.37.—The end of the tail is a prolongation of the *s* side of the earlier part, but is slightly curved, concave to *s*. (Naked eye.)

Aug. 4, 12.3.—Straight. The *s* edge extends furthest. (Specs.)

* M *Cam*. is in the brightest line of this, and P VI. 292 slightly precedes it.

Aug. 14, 10.40.—North edge most definite. (35.)

Aug. 18, 10.15.— " " " North
edge points to, and ends, slightly *s* of θ *Urs. Min.*; *s* edge points
to nearly half way from ζ to β . (3.5.)

12.10.—North edge ends slightly *n* of θ *Urs. Min.* (35.)

July 1, 12.25.—Sides slightly brighter than middle (20).
Width about 17' at 47' off nucleus.

July 20, 12.45.—Width of tail about 36' at 1° 40' off the nucleus. The *p* edge much more definite than the other. (20.)

July 27, 10.37.—Radius of that half of coma away from the tail, $5\frac{1}{2}'$. (38.)

July 29, 11.2.—It is 6'.3. (38.)

July 30, 12.0.—It is $7\frac{1}{2}'$ or $8'$. The *n* side of the tail much the brighter. (38.)

Sept. 14, 11.15.—Diameter of head 8'. (20.)

Sept. 16, 10.45.— ,, ,, 7½'. (20.)

Sept. 19, 8.50.— " " 15'. (20.)

From Oct. 30 to Nov. 24 I frequently observed the comet at Sunderland with the telescope (chiefly powers 38 and 20), and found it very faint, but rather large; generally 6' to 8' in diameter. But there seemed frequently to be a still greater, though very feeble, extension in one direction, or sometimes in more than one; making its longest diameter once as much as 12'. But, as these extensions did not always appear in the same direction, it occurred to me whether they were not merely an illusion, perhaps caused by the neighbourhood of small stars to the comet. At the same time, I could not make out that this was the case. Perhaps the continued large size of the comet was illusory also. With higher powers it looked much smaller; but this is no proof that the larger size with low powers was unreal.

Shortly after the last date mentioned above, the comet ceased to be visible in my telescope.

*July 1, 12^h 45^m to 13^h 15^m.—*With a Browning's miniature spectroscope on the $4\frac{1}{4}$ -in. Refractor, the nucleus has a bright continuous spectrum, with bright bands upon it; the continuous spectrum, however, being the more conspicuous part. The three usual bright cometary bands are conspicuous, and there is a much fainter one, not very easily seen, about as far off the most refrangible of the three as that is off the middle (brightest) one. I believe there is another near it, and that there are irregularities between them and the other bright bands. In the coma there are only the three usual bright bands, and they are much more conspicuous than its continuous spectrum.